Texas Technology 2003 Showcase
Case Studies on
Pumping System Improvements

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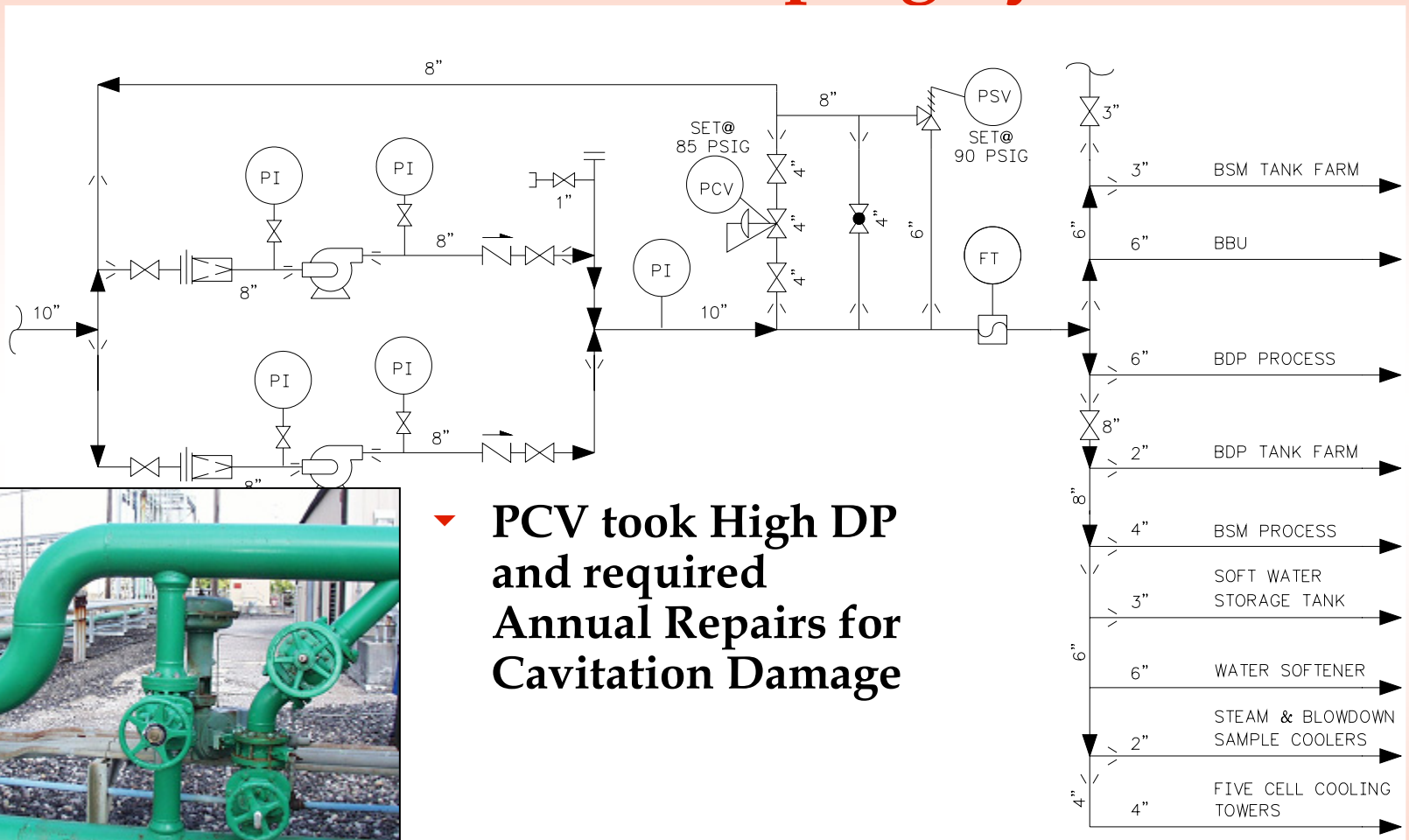
Deer Park Site

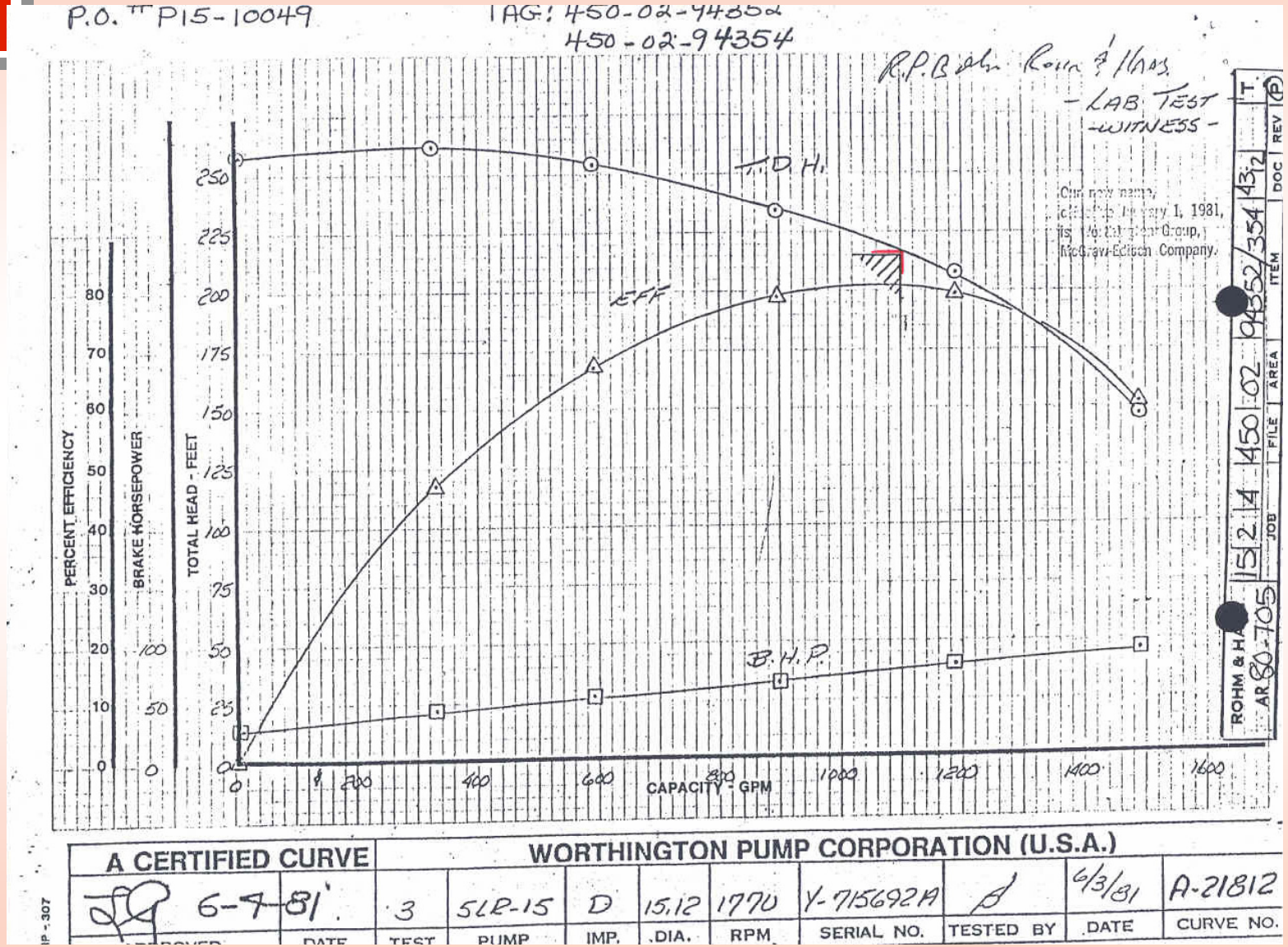
Original Design
Process Water Pumping System



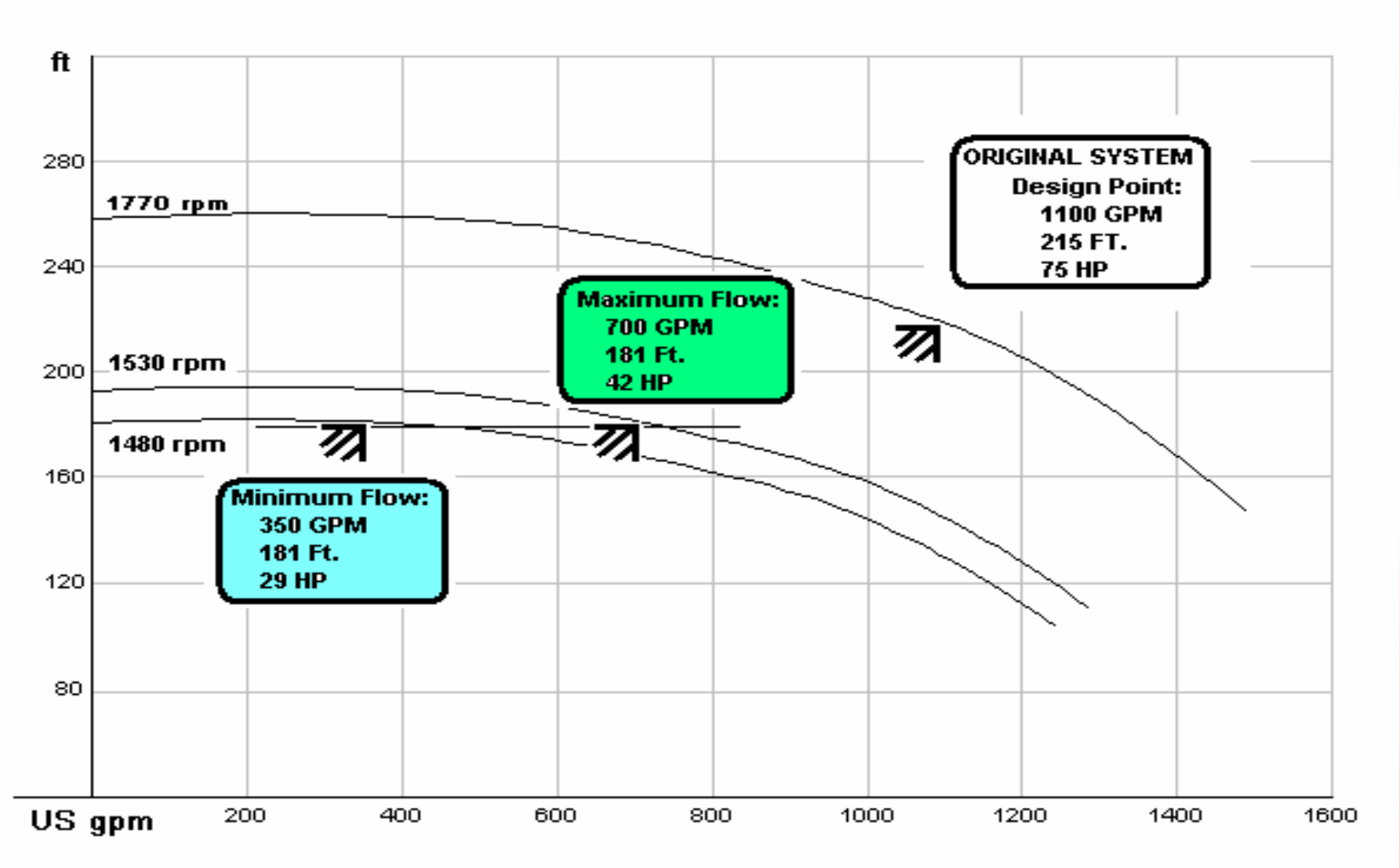
Original Bypass Control Hardware

- **PCV took High DP and required Annual Repairs for Cavitation Damage**

Original Pump Curve



Variable Speed Process Water Pump
System Flow Requirements Vary



Variable Speed Process Water Pump

Production Savings **$25,000/year.**

Energy Savings **$5,000/yr**

Cost to install **$20,000**

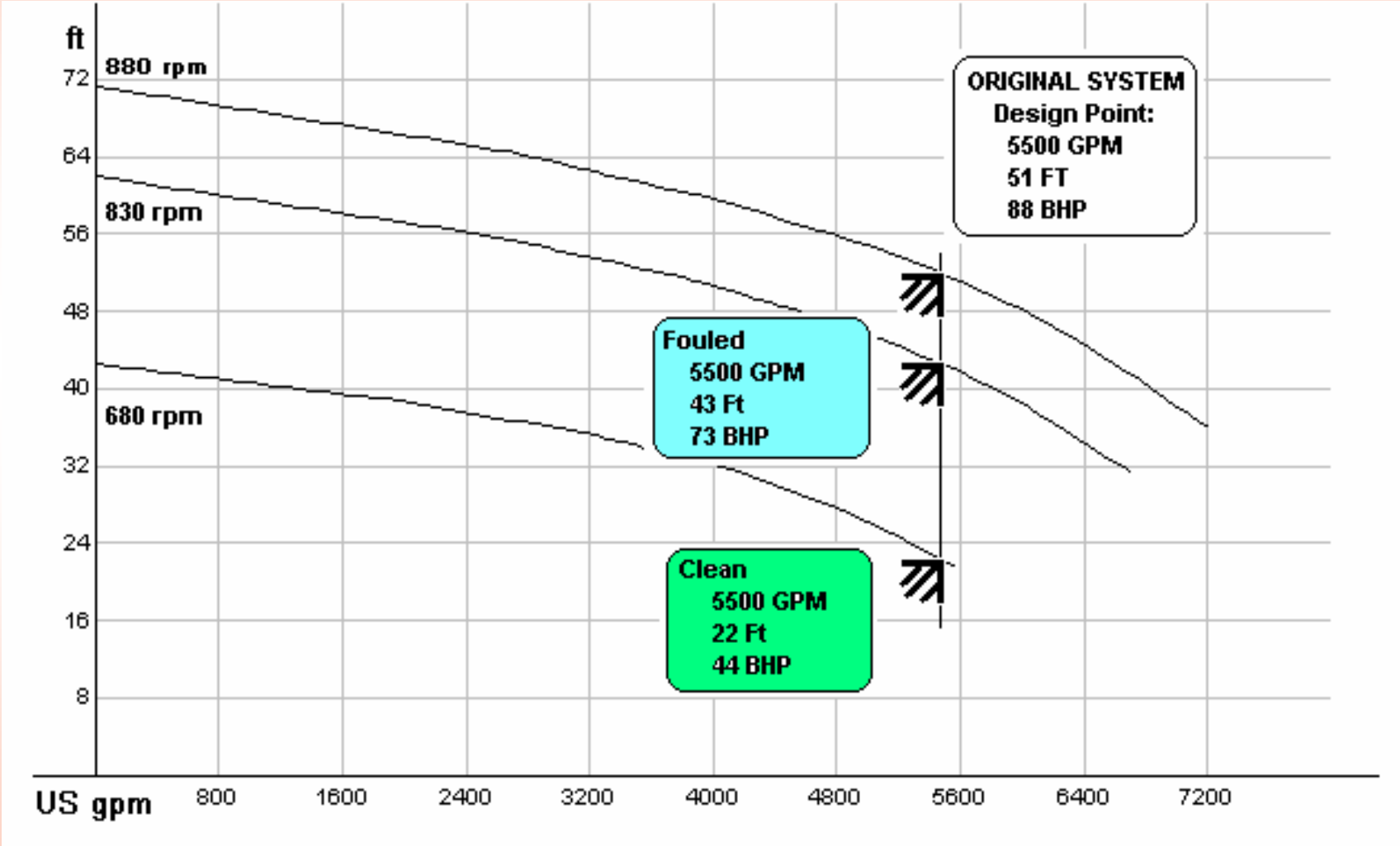
Energy savings alone would not justify this system.

Elimination of outages for process water system maintenance was the most significant factor. Annual rebuild of the control valve was required.

Variable Speed

System Head Requirements Vary

Variable Speed - Variable Head Pump Application



Variable Speed Pump Summary

- Range of flow or head requirements can be met by application of a VFD
- Significant benefits are available for existing installations
- Thorough system understanding is required for effective application of VFD controls
- Justification should include Energy, Maintenance and Lost Production costs.

Cooling Tower Pumps

Cooling Tower Pumps

- Total system flow not easily measured.
- Testing of individual Pumps not possible.
- Available Data consists of a prior tower thermal test, motor current, pump discharge pressure, and flow for one large user.

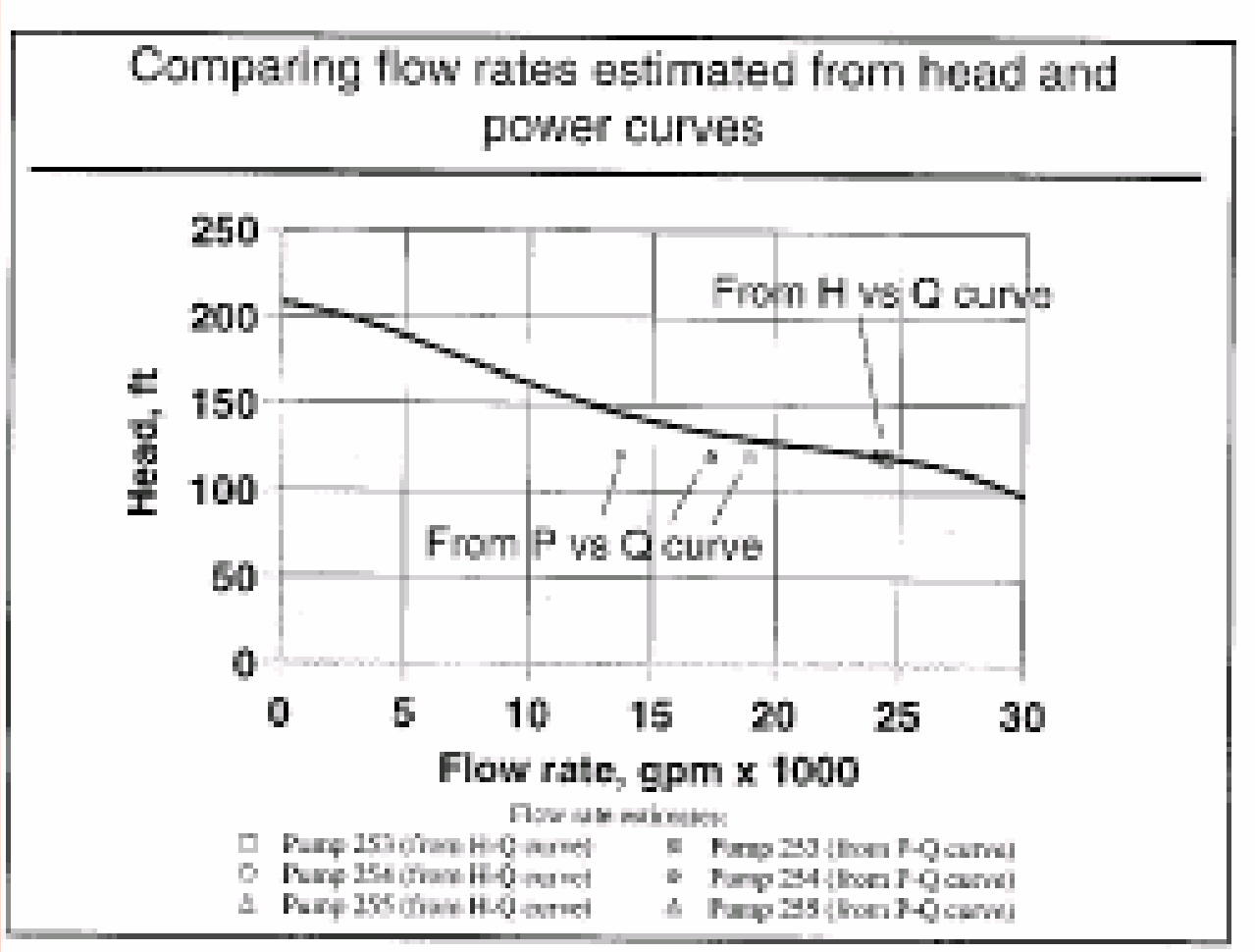
Cooling Tower Pumps

- Motor Information:
  - **1000hp**
  - **2300V**
  - **240amp full load**
  - **8 pole (885rpm)**
- Pump Information
  - **36” Bowl**
  - **25,000 GPM @ 120 ft**

Cooling Tower Pumps

- Flow trends indicate flow to major user dropping off over time
- DOE invited in to perform PSAT in July of 1999
- PSAT performed assuming manufacturer head vs. capacity curves correct
- PSAT also performed using motor power vs. capacity curves

Cooling Tower Pumps
Head and Power vs. Flow



Cooling Tower Pumps

- Options Evaluation concluded a new pump was more cost effective than a rebuilt pump.
- Selected a bowl and impeller replacement vs. a rebuild.
- Concrete pad modifications required.
- New pump could deliver 25,000 GPM at 150ft.

Cooling Tower Pumps

- **Summary:**
  - Cost for upgrade ~$250,000.
  - Costs avoidance on planned overhaul ~ $120,000 over 3 years.
  - Electrical Savings ~$70,000 per year based on calculated efficiencies from 1996 tower flow test vs. pump curve.
  - Additional water flow from pump upgrade.